

SCIENCE

FRIDAY, JULY 22, 1887.

THE SESSION of the National Educational Association at Chicago last week was a notable occasion. It was estimated by a competent authority that sixteen thousand teachers were assembled in the Exposition building when the opening session was held. Coming as they did from all parts of the country, — several of the Southern States excepted, — they were representative of the American public school in all its grades and phases. They were assembled to listen to the discussion of important questions, to talk together informally of school matters, and to view the great exhibition of educational material that was prepared for them. Despite the fact that several of the prominent speakers were not able to be present, the discussions were well sustained and attentively followed. The majority of the teachers present took more interest in the meetings of the sections devoted to matters of special interest than in the general meetings. It was very satisfactory to notice the ground gained by the advocates of manual training during the past year. This was clearly evidenced by the approval accorded to all references to it, by the character of the address by the President of the Chicago Board of Education, and by the great interest displayed in the exhibits of the work done at Chicago, Toledo, Cook County Normal School, and elsewhere. The exhibition was very complete, and well worth going a long distance to see. The States of Illinois, Wisconsin, and Michigan were particularly well represented. One fact was thoroughly demonstrated by the convention; namely, that despite the excitement and enthusiasm attendant on a large assembly, the Association's annual meeting has grown so large as to be unwieldy. Very many cannot hear what is going on, and very many more are dissatisfied at being afforded no proper opportunity to participate in the proceedings, while a few others who have long ago said all that they had to say that was worth hearing, continued to read papers and lead the discussions. In consequence of these facts, as well as because many teachers are unable to afford the expense necessary to attend a national convention, the proposal has been made to divide the Association into several, say four or five, each of which shall have its annual meeting and elect a quota of representatives to a central body, which shall meet annually and be deliberative, instead of hortatory and polemic, as the Association's meeting now is. This seems to us a most excellent plan, and we trust it may be soon adopted. The new president of the Association is Superintendent Aaron Gove of Denver, Colorado.

THE ECONOMIC BENEFITS of the work performed by the U. S. Geological Survey are just beginning to be appreciated by railway men who are laying out new lines of railroad. The officials of the Survey are of the opinion that within the next ten years the centre of all the railroad-building in the country will be located in the Southern States. They base this opinion on the fact that the calls for maps of the southern mountain ranges is increasing very rapidly. The maps thus far prepared by the Geological Survey cover the eastern coast-line from the Maryland boundary to the Georgia coast, with the exception of a small section of Virginia. They are at present issued only to those directly interested in the topography of the Appalachian range, yet there have been issued already upwards of three thousand five hundred maps of the region. That is to say, about a hundred different sets. These maps have all been distributed to those directly interested in the building of new railroads. It is said that there are somewhere about twenty

different roads in course of construction between the coal-fields of the South and the seaboard or the Ohio River. One gentleman, who is interested in the construction of a road between Charleston, S.C., and the mouth of the Big Sandy on the Ohio, called at the office of the Survey a day or two ago and said that the maps which had been furnished to his company had saved the corporation at least ten thousand dollars in preliminary surveys. From all sections of the South, reports are constantly received of the enormous value of the maps furnished by the Survey to topographical and civil engineers. Besides the work which has been done in the Southern States, the survey has been extended well into many sections of the North and West. Massachusetts has been mapped on a scale of a square mile to the inch, through the joint work of the State and the general government. A field-party has just begun operations in south-eastern Iowa for the purpose of mapping that State on a similar scale. Illinois and Indiana will, in all probability, be the next States in which the surveys will be undertaken. There is a great difference in the cost of the work in the various States. In the South, where the country is broken by mountain ranges, the cost is about twelve dollars a square mile; while in the prairie States of the West, where the country is flat, the work can be performed at about five dollars a square mile. It is the ultimate intention of the bureau to prepare topographic maps of the entire country. Owing, however, to the necessary slowness of the operations, it will be many years before the entire scheme of operations is perfected. As fast as the field-operations in each case are perfected and verified, the original maps are sent to the engraver, and a few copies are made for immediate use. Eventually there will be prepared an atlas of each State. These atlases will be of enormous value, not only to railroad engineers but to all municipalities who have use for an accurate topographic map of the country surrounding them.

AMERICAN PHILOLOGICAL ASSOCIATION.

THE nineteenth annual session of the American Philological Association was held in the Marsh-Billings Library of the University of Vermont, at Burlington, on July 12-14. In the absence of President Merriam, who is on his way to Athens, to take charge of the American School there for the ensuing year, the Vice-President, I. H. Hall of New York, occupied the chair. The attendance was not as large as usual, but this did not hinder the meeting from being an exceedingly interesting one, marked by the animated discussions which some of the papers aroused.

The reading of papers was begun, after the transaction of routine business, by Dr. C. K. Nelson of Brookeville, Md., who presented some interesting facts gleaned from a study of 'Murray's New English Dictionary,' Part iii. This part embraces the letter B from *batter* to *bozzom*, and contains 8,765 words. If we add to this about 3,000 words under B in Part ii., and estimate the remaining words at the same figure, we have, for entire B, 14,765 words, or more than twice the number given by 'Webster's Unabridged,' which has only 6,750 words. Of the 8,765 words in Part iii., 5,323 are main words, 1,873 compound, and 1,569 subordinate words; and of these main words, again, 3,802 are in current use, while 1,379 are obsolete. A feature of this letter is the small proportion of Latin and Greek words found under it, aggregating not quite twenty-five per cent. In summing up, Dr. Nelson said that "this part of the great English Thesaurus impresses philologists more and more with the fact that the creative period of language is by no means arrested. Sanscrit, and Latin, and Greek have crystallized linguistic forms, which afford splendid specimens of immutable structure, but it is in the living language, where words are

created as they are needed, that we have the opportunity of witnessing the phenomena of perennial growth."

Tuesday evening, a well-attended public meeting was held in the chapel of the University, when Prof. J. H. Wright, the Secretary, read President Merriam's address on a 'Review of the Greek Inscriptions Published During the Past Year.' It is to the monuments, which the soil of Greece has preserved in such large numbers, that we have to look for an increase of our knowledge of Greek history and civilization, and for a solution of the many problems still unsolved. Already the results of the explorations, which have been going on busily for some time, are beginning to make themselves felt, and it is not too much to say that Greek history will yet have to be rewritten in the new light shed upon events by the testimony of the stones. The past year has been, on the whole, an important and fruitful one. Greek inscriptions of particular value have been found in Naukratis, under the auspices of the Egypt exploration fund, at Sigle in Crete, at Epidauros, and near the Peiræus, the harbor of Athens. It is within the domain of the history of the Greek alphabet that the most valuable results of the last year's work are to be sought. The rest of the address was devoted to an elucidation of these results.

At the session on Wednesday morning, Prof. F. A. March read a paper—that may in many respects be called remarkable—on 'Standard English.' He claimed, in opposition to the 'new phonetists,' that there is such a thing as standard English, defining it as the 'heir of all ages recorded in grammars and dictionaries.' Standard English, meaning by that both the proper use of words and their proper pronunciation, is an authoritative institution,—a stronghold of the unity and power of the Anglo-Saxon race. While it is true that speech in its simplest form is without reflective purpose, yet, when a higher state of civilization is reached, its growth proceeds under the guidance of reason. The development which the English language has taken since the days of Milton and Shakspeare is a proof of this. We are, therefore, not only justified in guarding jealously our standard English from contamination through impure influences, but it becomes, also, the duty of scholars and cultured people in general to superintend its growth. Students of language have it as their specialty to preserve and perfect the records of the language. The paper, which was thoroughly suggestive throughout, gave rise to a long, and at times animated, discussion, in which a large number of the members participated.

Professor Seymour of Yale College gave a report of the doings and needs of the American School at Athens. It will be remembered that some months ago the permanent Directorship of the school was offered to Dr. Charles Waldstein, who accepted the same, subject to the condition that an endowment fund of \$100,000 be raised in order to place the institution on a sound financial basis. Up to date, \$10,000 of this sum have been subscribed,—which, it must be confessed, is not a very encouraging showing. Still, there is a fair prospect that before the expiration of the time assigned by Dr. Waldstein,—October, 1888,—the remaining ninety thousand will be forthcoming. With the aid and encouragement which the school has received from the Greek government, such as the recent gift of a suitable site for a building,—which, it is pleasant to record, is in process of erection,—it would be indeed lamentable to see so important and valuable an undertaking maimed by our own indifference to its fortunes.

Prof. W. F. Allen had an interesting paper on 'The Monetary Crisis at Rome in 33, A.D.' The crisis in this year, which was so severe that it required the intervention of the Emperor Tiberius to restore credit by advancing, from the Treasury, a sum equivalent to four million dollars, in the form of loans without interest, was the necessary outcome of the conditions prevailing in ancient Rome, which made money-lending a curse and the money-lender an evil. At the present time, the legitimate business of bankers consists in advancing funds to be employed for productive purposes: the banker is therefore a highly useful intermediary between those who have money which they do not understand how to use productively, and those who are engaged in industrial occupations in which they can use to advantage more capital than they themselves possess. But there was no such thing as productive industry, on a large scale, in Rome. When money was borrowed, it was merely for purposes of future consumption, or to pay for past consumption. Money

was borrowed in order to pay a debt incurred, and therefore carried with it the incurrence of a new debt. The consequence of this state of things was, that a large body was growing deeper and deeper into debt, while a few—the money-lenders—reaped benefits out of all proportion to the services rendered by them. Already in Cæsar's time the attempt was made to counteract this threatening evil by the passage of a law for the regulation of loans and of debts. It aimed, as far as we are able to trace it, on the one hand, to prevent a scarcity in the money-market, by limiting the amount of cash an individual could have on hand, and obliging him to invest what he had above this sum in real-estate, and, on the other hand, made provision for the payment of outstanding debts, by an extension of time and by compelling creditors to take real-estate as payment. The law, however, remained a dead-letter until the days of Tiberius, who made an attempt to revive it. The attempt failed, and the much-feared crisis broke out. But it is a testimony to the wisdom of Tiberius that he foresaw its coming, and endeavored to prevent it by all means in his power. In order to relieve the debtors of their embarrassment, he issued the loans as above set forth, which was of course only a temporary relief, not a remedy for the evil.

Professor Greenough of Harvard University had some suggestive Latin etymologies to offer, among others, that of *elementum*. He favored the explanation, common in former days, but latterly superseded by other views, according to which it was an artificially coined word composed of the three letters *l, m, n*. The *l* was due to the force of analogy, so as to make the word conform with such forms as *rudimentum*, *alimentum*. Dr. H. Weir Smyth of Johns Hopkins University had an elaborate treatise on the Arcado-Cyprian dialect, which endeavored to cover the entire field of the famous Cypriot inscriptions, of which the Metropolitan Museum in New York has such a rich collection, and, by a minute examination, to make clear the relation in which the Cyprian stood to the other Greek dialects. Professor Hale of Cornell had two papers, one proposing a new terminology for the Latin tenses, the other on the 'Cum-constructions in Latin; Their History and their Functions.' Dr. Cyrus Adler of Johns Hopkins, in a review of the article 'Semitic Languages,' in the 'Encyclopedia Britannica,' took grounds against the writer, Professor Nöldeke of Strassburg, for the subordinate rank which he assigns to the Assyrian among the Semitic languages. Dr. Adler claimed, that, in consequence of this, the article was not up to the mark of our present science. Professors Jastrow and Hall made some remarks in reply. Other papers were as follows: 'Conditional Sentences in Æschylus,' by Professor Clapp of Illinois College; 'Long-Vowels in Old Germanic,' by Dr. Wells of Providence, R. I.; 'Delitzsch's Assyrian Dictionary, Part i,' by Prof. Morris Jastrow, Jun., of the University of Pennsylvania.

On Wednesday evening the Association was entertained by Dr. and Mrs. Sears, and on Thursday, after the closing meeting, an excursion was taken to the Au Sable Chasm.

Before adjourning, the following officers were elected: President, I. H. Hall of the Metropolitan Museum, N. Y.; Vice-Presidents, Professors Seymour of Yale and Lanman of Harvard; Secretary and Treasurer, Prof. J. H. Wright of Harvard; Executive Committee, Professors Whitney, Gildersleeve, Perrin, and March. The next meeting of the Association will take place at Amherst in the second week of July, 1888.

IS CONSUMPTION CURABLE?

THE discovery by Koch in 1882, of the tubercle bacillus, gave a new impetus to the treatment of consumption. The investigations of Toussaint and others had made it more than probable that tuberculosis was an infectious disease, but the discovery of the actual germ which caused the disease seemed to open up to the victims of phthisis a means of escape from a fate which up to that time had seemed inevitable. That the hope thus aroused has not yet been realized is not due to any lack of enthusiasm on the part of the medical profession; for, ever since the nature of tuberculosis was established, search has been made for some means by which its germs or their products might be destroyed, and thus the disease arrested.

We have recently had occasion to mention two methods of treat-

ment from which much advantage was promised and expected, — those of Kremianski and Bergeon. The former, which was based on the fatal effect of the most dilute solution of aniline on the bacillus, has had but a brief existence, and, so far as we can learn, has been abandoned as being not only of no practical benefit, but as being actually dangerous to life.

The Bergeon method, on the other hand, seems to promise very much, and, as it is now being extensively employed, its value will doubtless soon be determined. This consists in the introduction into the body of sulphuretted hydrogen and carbonic-acid gas. Lecturing on the subject of tuberculosis at the Hôpital de la Pitié, Paris, M. Debove, in 1883, said the ideal end toward which physicians should always strive when in the presence of a parasitic disease, such as phthisis, is to find a parasiticide acting in the interior in the same manner as external remedies act which are employed for the cure of itch. It is necessary to find a substance which, without injuring the system, will be destructive to the parasite. Dr. Bergeon, senior deputy-professor at the School of Medicine at Lyons, suggested the use of hydrogen sulphide, carbon disulphide, and other antiseptic substances, associated with pure carbonic-acid gas, — agents which comply with the requirements of Debove.

A pamphlet by Dr. V. Morel, published by James W. Queen & Co., Philadelphia, entitled 'New Treatment of the Affections of the Respiratory Organs and of Blood Poison by Rectal Injections of Gases after the Method of Dr. Bergeon,' contains the experimental evidence on which this method is based, together with a description of the apparatus by which it is to be applied.

The agents by which the bacilli were to be destroyed having been determined, the next step was to devise means for introducing them into the human body without injury. Two methods of introduction presented themselves: the one, by inhalation; and the other, by introduction into the digestive tube of the same substances in such manner as to be eliminated by the lungs. Dr. Morel states that many inconveniences, grave dangers even, oppose the adoption of the method by inhalation. These antiseptic substances are endowed with great toxic power when they penetrate the arterial system, either directly or by way of the lungs, and Claude Bernard has demonstrated that the agents introduced by this method act almost immediately. In addition, they possess a very great local irritation, and this action, exercised on an organ already diseased, cannot but augment the pre-existing lesions. This is, doubtless, the reason that there has been so little success gained in inhalations in the treatment of phthisis, and the disagreeable odor of these substances has contributed to their being refused by the sufferers.

The introduction of antiseptics by the digestive tube does not offer the same dangers. Bernard has demonstrated that when toxic matter is introduced into an organ removed from the arterial system, — in the digestive tube, for example, — it does not enter into the arterial system, as it is eliminated before penetrating so far. It has then to traverse the portal veins, the liver, the hepatic veins, and the pulmonary tissue. Now, in this course it can be eliminated in the liver by the bile, and in the lungs by exhalation if it is volatile. Claude Bernard, after experimentation, stated that hydrogen sulphide can be introduced with impunity into the digestive tube, or into the veins, if care be taken not to give too great quantities at a time.

The next question to be decided was whether the antiseptic substances should be introduced by the mouth or by the rectum. Inasmuch as they reach the lungs through the same channels by whichever way they are introduced, it would seem to be a matter of indifference which of these two entrances was selected. From a case in which a fatal result followed the introduction by the mouth, Morel thinks that this may indicate that the essential action of the medicament is not the same in both cases. In addition to this, it is important in the adoption of a method of treatment that preference should be given, other things being equal, to that one which is most agreeable to the patient; and, inasmuch as both the odor and the taste of these antiseptics is very disagreeable, the rectal method is to be selected. By introducing the remedies by the mouth and stomach, we are also in danger of interfering with digestion and alimentation, which are especially important in the class of invalids under consideration. For these reasons, Dr. Bergeon has abandoned the method of injection into the stomach.

Having adopted the method of rectal injection, it was next necessary to find a medicament which would be exhaled by the lungs, and which while in those organs would destroy the tubercles bacilli.

The first experiments of Dr. Bergeon were made on animals, with chlorine, turpentine, ether, ammonia, and bromine; but these substances provoked an immediate and violent inflammation of the rectum, and even caused mortification of parts of the mucous membrane, and were therefore abandoned. A mixture of carbonic acid and hydrogen sulphide was perfectly tolerable when the two gases were pure and completely deprived of atmospheric air. In their union the carbon dioxide plays in some degree the part of an inert body, attenuating in all cases the irritating properties of the sulphuretted hydrogen. We know that sulphur possesses germ-destroying properties, and nothing is more logical than to apply it to the treatment of pulmonary tuberculosis. The sulphuretted hydrogen is taken up by the venous system and eliminated by the lungs, — thus this gas seems to fulfil all the requirements.

The apparatus by means of which these gases are prepared and injected is the invention, or adaptation, of Dr. Morel. It is constructed on the principle that a current of carbon dioxide passing through, or over, certain gaseous, or volatile, substances will carry with it a certain quantity of these substances: it produces a disassociation of the gaseous elements which they hold, and these elements, being liberated, are carried with the current of carbonic-acid gas. It is necessary, first, to produce very pure carbonic-acid gas, and, second, to pass this gas through a liquid medicated with these volatile substances, and to cause it to penetrate the rectum, and to prevent its return to the receptacle for the carbonic acid. The carbonic acid is produced by the action of sulphuric acid on bicarbonate of soda. Hydrochloric acid has been used, but a little always escapes with the carbonic-acid gas, and produces an irritation of the intestine. The carbonic-acid gas as it escapes from the generative flask is collected in a rubber bag. In order to avoid colic, the gas must not contain any atmospheric air. The injection-apparatus consists of the rubber bag filled with carbonic-acid gas; of a rubber bulb with a valve at each end, to which are adapted rubber tubes, one of which is red and the other black, so as to distinguish the valves; a metallic T-tube, the vertical branch of which, with a valve at each end, is plunged in the bottle containing the medicated liquid; and, last, a rubber tube with a pipe on the end for insertion into the rectum. These parts are attached in such manner that the carbonic acid is drawn into the bulb, then forced into the medicated solution in the bottle, taking up the sulphuretted hydrogen, and together these gases are forced into the intestine.

After describing the apparatus and the method of its use, Dr. Morel calls attention to certain precautions which are to be taken in making the injection. These include the attitude of the patient, the necessity of proceeding with caution, and, at first, its administration by the physician himself, the time occupied in giving the injection, and the amount of gas injected.

The natural mineral-waters which contain natural sulphuretted hydrogen or sulphides of sodium or calcium have, as a usual thing, been employed by Drs. Bergeon and Morel, being preferred to the artificial waters. The principal springs which contain a sufficient quantity of sulphuretted hydrogen gas or of sulphides for rectal injection are Allevard, Aix en Savoie, Eaux-Bonnes, and some fifteen others. To obtain permanent results, the treatment must be continued for months, in order to place the bacilli in a local bath of antiseptic vapors, which at length will destroy their virulence and power of reproduction.

The results obtained by Dr. Bergeon in the treatment of consumption by his method of rectal injections were communicated to the French Academy of Science in July, 1886, and to the Congress of the French Association for the Advancement of Science, at Nancy, in August of the same year; and in October the distinguished Professor Cornil made a communication to the Academy of Medicine on the subject. These results of Dr. Bergeon have been confirmed by physicians of Lyons, Paris, Geneva, and Marseilles. These physicians have observed the rapid disappearance of the symptoms of pulmonary suppuration in consumptives, and a progress toward a state of health, which has all the characteristics of a complete cure. Dr. Bergeon says that those whom he considers cured do not ex-

pectorate, or offer to auscultation any stethoscopic signs but those of dryness due to the presence of cavities which have cicatrized, or are in process of cicatrization, or to cicatricial bands consecutive to old lesions. Some of these patients have been obliged to take up again a very laborious existence. Mounting a great many stairs many times in the course of the day, nevertheless, their respiratory organs have resisted all these fatigues, and the improvement gained has been steadily maintained. In most of the patients, in two or three days, there is a marked diminution of the cough, the expectoration, the night-sweats, and the difficulty in respiration, which accompany pulmonary phthisis; in time, the patients gain a feeling of health and an increase in strength. Little by little the favorable symptoms gain the advantage, and the patients cease to lose flesh, and commence to gain it.

Dr. Morel notes the remarkable fact, that, even in patients who are apparently restored to health, the tubercle bacilli are still present in the sputum, and says that it remains to be ascertained if the bacilli which persist in the sputum, notwithstanding the return of health, still possess their functional activity, that is, the property of developing to any great extent, to infiltrate anew the pulmonary tissue, and there produce lesions similar to those which have been cured by the administrations of medicated gaseous rectal-injections. The constant presence of the bacilli in the sputum, after health has been restored, indicates two things; first, that their hurtful action is neutralized for a long time by the medication, and, second, that as long as they remain in the sputum, a return of the malady is to be feared, and on this account the injections should not be abandoned, even though it appears that the cure is complete. Many persons who have been so improved after several weeks of treatment as to consider themselves cured, have discontinued the injections, and have suffered a relapse.

Dr. Morel states that it is not the bacilli which are to be feared in phthisis, but the septicæmia caused by their presence in the pulmonary cavities, this being due to the absorption of the infectious products of the bacilli. The elimination of the medical principle in the gaseous injections by the alveolar and bronchial surfaces of the lung combats victoriously this septicæmia. While this elimination is taking place, these infectious products are neutralized, or better, are not absorbed. When the pulmonary lesions are completely healed the injections must be discontinued, because, the bacilli being no longer in contact with a diseased surface, there is no fear of septicæmia. But if the injections are stopped before the walls of the cavities are entirely cicatrized, or if the cicatrization is not rendered permanent by prolonged treatment, the cicatrized part will ulcerate anew, and by the contact of the bacilli the septicæmia is renewed. It is then necessary, in order to prevent the return of the malady, to take the injection time after time, even when the state of the health is satisfactory, and, with still greater reason, if the old symptoms, cough, expectoration, fever, and emaciation reappear.

It has also been noted that the improvement is not confined to the lung-lesions. When tubercular ulcerations of the larynx and pharynx exist, these are also cured without any further applications, solely by the contact of the gases as they are exhaled from the lungs.

Dr. Chantemesse, chief of the laboratory of bacteriology of the faculty of medicine, Paris, and physician of the hospitals, reports nine patients in his practice who had presented both the local and general symptoms of pulmonary tuberculosis, with the presence of bacilli in the expectorations, as having undergone great improvement under Bergeon's treatment; the increase in weight was rapid, sometimes a kilogram a week, while the cough and the expectoration were considerably diminished. The bacilli remained constant in the sputum. Professor Cornil is now engaged in experimenting upon tuberculous animals. He says that the rectal injection of carbonic-acid gas and of sulphuretted hydrogen constitutes an excellent therapeutic method in phthisis, and should gain more favor, in view of the fact that therapeutics are powerless in the face of phthisis. In this disease the only agents which till now have been found useful are foods and those remedies which aid nutrition. Dr. Morel claims that this method of treatment is not confined to tuberculosis. He claims much benefit from it in whooping-cough, bronchitis, and in the infectious diseases, such as typhoid-fever, the

eruptive fevers, and septicæmia, in which blood poisoning results from the introduction into the blood of infectious products of microbes. The infectious elements, spread throughout the blood, come in contact with the medicated gas, not only in the lungs, as in tuberculosis, but also in the right heart at the moment when the blood of the two venae cavae is united, and in all its course through the branches of the pulmonary artery. The venous blood, thus purified, frees itself of the excremental products on its arrival at the pulmonary cells, and re-enters, disinfected, the branches of the pulmonary veins. Thus is explained the diminution of fever and the amelioration of the disease which occur in the cases where gaseous injections are employed.

Drs. Spillman and Parisat have made experiments to determine to what height intestinal distension reaches after injecting eight pints of gas, and find that in the cadaver the large intestines only are distended. They find it impracticable to use a larger amount in the living subject on account of cramps and the danger of producing paralysis of the intestines. They conclude, from their experiments, that the method of Dr. Bergeon is powerless in averting tuberculous exacerbations; much less is it capable of arresting the development of phthisis. The night-sweats do not seem to have been influenced by the medication, and the temperature was not permanently lowered. The appetite was not disturbed, but there was temporary intestinal uneasiness, with distension of the abdomen, rendering confinement to the bed necessary. The weight remained the same; sleep was quiet and restful, due solely to the carbonic-acid gas. According to these writers, rectal gaseous-medication is palliative, not curative.

In England, the method has been employed by Dr. Bennett, and by Dr. Heron at the Victoria Park Chest Hospital. The London *Lancet*, in commenting on the method, says that the evidence is forthcoming that the treatment has been followed by many signs of improvement in at least some of the patients, and urges a more extended trial. The writer in that journal does not think it necessary to suppose that the gas must act after the fashion of a true germicide or antiseptic, but it may be that the value of the treatment, supposing it to have any, consists in improving the nutritive powers of the tissues, in increasing their vitality, thereby rendering them more able to cope with deleterious influences, or with the germs, by affording an unsuitable soil for the activity of the latter.

In our own country, much has already been done in testing this new plan of treatment. Dr. Crane of Chicago has used it in four cases, two of phthisis, one of intussusception of the bowel, and one of spasmodic croup. With the latter cases it acted like a charm, overcoming both almost instantly. In the case of croup, carbon bisulphide was used instead of sulphuretted hydrogen. One of the phthisis cases was a man, aged twenty-six years, whose two sisters and brother had died from that disease, and who had been under treatment for three years, during which time he had been twice to Colorado. Under the sulphuretted hydrogen he improved very fast, in one week his temperature becoming normal, the night-sweats almost stopped, and the expectoration became less. In the latter part of the second week of treatment he ventured out on a rainy March day, took cold, and died in two days. The second case was that of a widow, aged twenty-four years, whose mother and sister died from phthisis. She was suffering from incipient phthisis. She made seven visits to Dr. Crane, and then pronounced herself cured. The doctor thinks that she will probably have a return of her symptoms upon the slightest provocation. He has tried the mineral waters of Lafayette, Ind., Blue Lick, Ky., and Ypsilanti, Mich., and considers the last best adapted for the purpose. It is so strongly impregnated with gas that he is able to use it a second time. He has devised an apparatus for the manufacture and injection of the gas, differing from Morel's in no important particular, save in the expense of manufacture, which is reduced about one-half.

Dr. M. M. Johnson, of Hartford, Conn., has been using Bergeon's method in the Hartford dispensary for two months. The patients are mostly those in advanced stages of phthisis. The night-sweats have ceased, the cough has become loose and expectoration easy, the patients sleep well and have increased in weight, the circulation is quickened, and the cold, clammy extremities have become warm.

The treatment has not been carried on long enough to enable an accurate estimate of its true value to be formed.

Dr. H. C. Wood states that the method has been used in the Philadelphia Hospital in a large number of cases, and that a personal inspection shows that the statements made by the French observer are correct, and that there seems to be no doubt that under the treatment there is rapid alteration of some cases of phthisis for the better. Dr. Wood thinks that Bergeon is wrong in supposing that the natural waters are superior to the artificial. In Philadelphia the bottle is charged with ten grains each of chloride of sodium and sulphide of sodium, and this answers for a number of patients. The amount of sulphuretted hydrogen received by each patient is unknown and very variable, and is very small. Dr. Wood thinks that the evidence is already sufficient to indicate that we are in the presence of a very important addition to medical therapeutics, and that it is of vital importance to decide the mode in which the treatment acts.

The experiments of Dujardin-Beaumetz show that the sulphuretted hydrogen is the medicinal agent, and not the carbonic-acid gas. He thinks it improbable that the good achieved is the result of any parasitoidal influence. There is, at present, no proof that sulphuretted hydrogen, when it does good in phthisis, acts by killing the bacilli, and there is still less proof that it in any way increases the direct resistive powers of the individual to the action of the bacilli. It is probable that Bergeon's plan is simply a means of making an application of sulphur to the pulmonic mucous membrane and tissue, and this view is confirmed by the benefit resulting from the treatment of asthma and pulmonic catarrh by the same method. Dr. Wood had under his care a patient who had met with a railway accident, followed by pleurisy and pneumonia, whose symptoms led him to believe she would die. He employed the gaseous injection, and at the time of his writing he considered her as convalescent. In this case, although rectal injections were at first employed, subsequently Dr. Wood gave by the mouth the sulphuretted hydrogen in saturated solution artificially prepared, and the effects were apparently the same.

In order that the solution may be uniform in strength, Dr. Marshall of the University of Pennsylvania has devised an apparatus by which it may be made by the patient at his own home. The liquid is sweetish, and not at all unpleasant to the taste.

From the foregoing *résumé* of what is being done abroad and in this country in testing the efficacy of Bergeon's method, it will be seen that the evidence is gradually accumulating to determine its efficacy. It is still too early to declare that tuberculosis is curable, and that the method by which the cure is to be effected has been discovered; at the same time much may be hoped for from a therapeutic agent which has the support of so many well-known authorities in medical science. We deem the matter of sufficient importance to bring it thus fully before our readers, and shall keep them informed on the subject from time to time.

MENTAL SCIENCE.

The Natural History of Error

THERE is always a strong psychological interest in the study of such phenomena as the English Psychic Research Society investigate, apart from all considerations of the ultimate bearing on the truth of any theory. No matter whether houses really are haunted, or the raps made by spirits, or thought transferred from mind to mind; it will be of great value to ascertain how belief in these unusual manifestations arises and progresses, to be on the alert for facts apparently favoring their genuineness but really pointing to obscure psychological processes which might otherwise be overlooked. These important side-issues and preliminary investigations have been much neglected by the English society, and it is an encouraging circumstance, that, in their most recent issue, they make an important step towards making good this neglect.

Messrs. Richard Hodgson (now secretary of the American society) and S. J. Davey contribute a highly important paper on 'The Possibilities of Mal-Observation and Lapse of Memory from a Practical Point of View.' Mr. Davey became interested in spiritualistic phenomena several years ago, and was so deeply impressed with what he saw, as to be on the high-road to conversion, when

he gradually gained a truer insight, and through skill and practice can now perform many of the medium's favorite manifestations. His specialty is the slate-writing phenomena, — 'psychography' is the technical word, — and in these he has achieved great success, his performance having been declared superior to Englington's. Mr. Davey, under the assumed name of Clifford, gave sittings to friends of Mr. Hodgson and others: he did this, not as a medium, took no fee, but simply posed as a phenomenon, asking his spectators to watch him as they would a conjurer, and afterwards to send him a *detailed written account* of what they had seen. These accounts are all published, and are extremely instructive. What was really done is here accurately known, and a comparison of this with the accounts of the 'sitters' at once shows how reputed marvels come to being, simply by inaccurate description. One must remember, too, that Mr. Davey was decidedly in a less advantageous position for deceiving and exciting wonder than a professed medium; for the latter, at the worst, deals with a person who has a little belief in the possibility of some supernatural agency, and this remnant of belief induces a mental attitude that does not watch trifling movements, slight delays, and so on. The witness of a conjurer's performance has an interest in minimising the mystery of the tricks. Some of Mr. Davey's sitters had no notion that they were to witness mere slight of hand, others more or less strongly suspected it, and a few were as much as informed of it beforehand. It is extremely interesting to see how the report of each is modified by his previous knowledge. One gentleman, whom Mr. Davey met at a séance, spoke very disparagingly of the performances of an amateur conjurer known as Mr. A., and remarked that Mrs. Sedgwick's attempt to explain 'psychography' by such powers were totally inadequate: after the performance, he declared that what he had just seen through 'Mr. Clifford' was more conclusive of the existence of supernatural powers than the evidences furnished by a distinguished medium. The joke of the story is that the amateur conjurer Mr. A., 'Mr. Clifford,' and Mr. Davey are all one and the same person.

None of the 'sitters' were able to explain how the thing was done, though one gentleman ventured the information that he was sure it was *not* done in such and such a way. Had he omitted the 'not,' he would have been nearer right than any. Some observed a few points correctly, but most had simply to record what they saw. On reading these reports, many a reader will imagine that *he* would certainly not commit such an error in description; this is assuredly an illusion. Some of the reports are exceptionally good. To describe accurately is a rare gift. It means scientific success. It is possible only after repeatedly witnessing the same performance. This mal-observation is natural; its absence is the exception.

It is time to turn to Mr. Hodgson's analysis of the kinds of error which these reports show. There are four convenient groups of such errors. First, are errors of 'interpolation'; something is inserted as having happened which really did not happen: the subject declares he examined slates when really he did no such thing. Second, errors of 'substitution'; the subject declares he examined the slate in every detail, when really he only glanced at it. Third, errors of 'transposition,' in which the event is correctly described, but is described as happening later or earlier than it really did (many a reputation has been made by skilfully utilizing this tendency). Last, errors of 'omission,' in which events apparently trifling are not noticed at all. These it is the object of the medium to induce by distracting the attention in one way or another; and it is just through exaggerations and misrepresentations, which these erroneous tendencies bring about, that the simple doings of the mediums become marvels in the mouths of enthusiastic narrators. It is all a question of attitude: what is utterly unimportant to observe, if the medium is believed to be acting under the control of spirits, becomes the most important, if he is regarded as a trickster. It has been a stumbling-block to many minds to understand how mediums could acquire such great reputations as wonder-workers, if they really did nothing more than these simple tricks. The mystery of this falls away if we remember that the power of accurate description is a rarity, and that, as is here experimentally proven, the amount and kind of distortion which mal-observation and errors of memory produce is perfectly sufficient to make a spiritualistic marvel of a conjurer's trick.

EXPLORATION AND TRAVEL.

New Explorations in Central Africa.

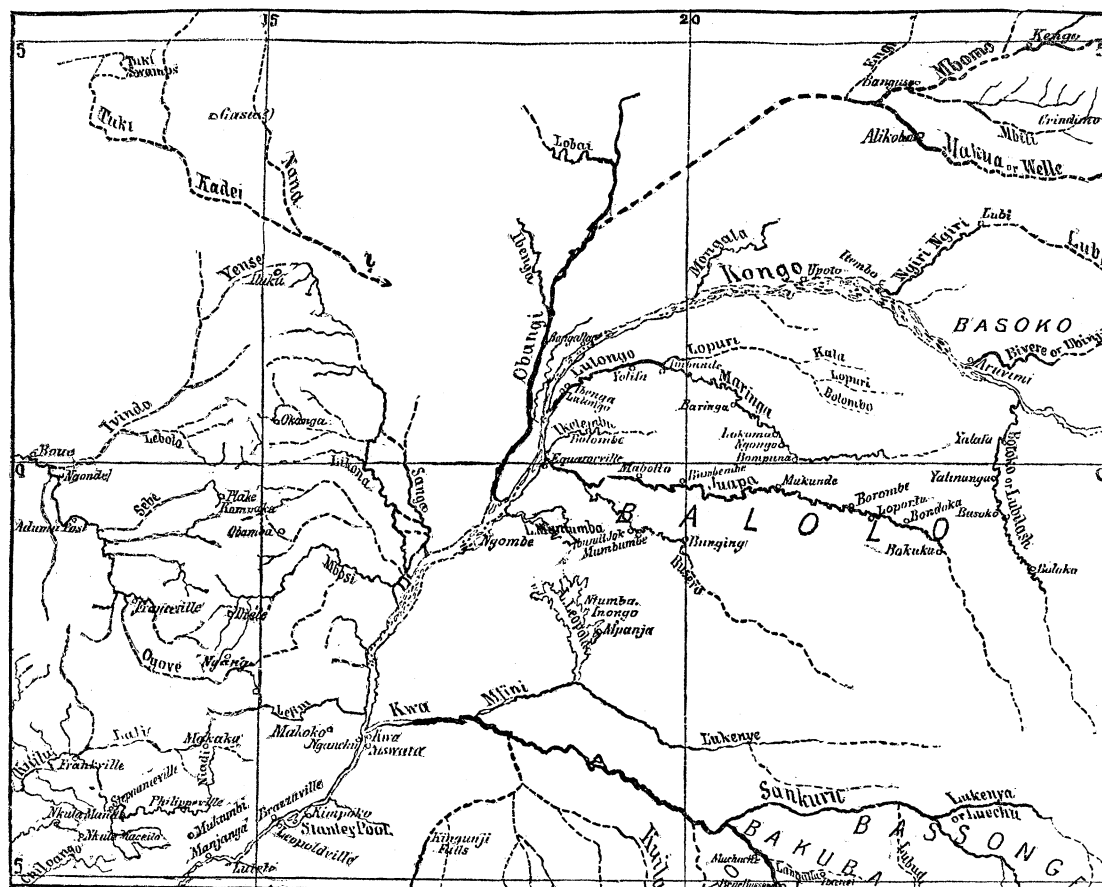
THE progress of explorations in the Kongo Basin is so rapid that our map of May 27 does not fully correspond to the present state of our knowledge. Therefore we reproduce in the present number the part in which the most important discoveries have been made, corrected to date. The Mongala and the tributaries of the Obangi are drawn more accurately from new maps published by the *Mouvement géographique*, but the most remarkable features of the new map are the discoveries of Giacomo de Brazza in the region between the Obangi and Ogove, which were published in the Bulletin of the Italian Geographical Society. Though it is more than a year since this traveller returned from his journey, the map has been published only now, but as it is not based on the longitudes of Captain Rouvier, the positions had to be corrected accordingly. De Brazza started from the upper Ogove. First he made several short excursions in the region between the upper Ogove and the

the *Mouvement géographique* that Captain van Gèle has ascended the Lopuri, the tributary of the Lulongo. The upper part of this river runs in a north-westerly direction, and approaches the Kongo closely in longitude $21^{\circ} 26'$. Then it takes a south-westerly course. The parallelism of these rivers with the Kongo explains the absence of tributaries in the central part of its upper course.

HEALTH MATTERS.

Pasteur's Methods.

RECENT criticisms of the inoculation-method of Pasteur for rabies have been very unfavorable; but the report of the English Committee will undoubtedly turn the tide again in the opposite direction. It will be remembered that this committee was appointed by the President of the Local Government Board, in April, 1886, to inquire into Pasteur's treatment of this disease. Its report has just been presented to Parliament. The value of such a report depends en-



MAP SHOWING LATEST INFORMATION ON THE KONGO BASIN.

Alima, and then started on his important journey. He left Madi-ville on July 12, 1885, travelling in a north-easterly direction. He crossed the Sebe farther north than this river was supposed to run, and crossed the water-shed between the Likona and Ogove under the equator. The most northern point reached is Iluku, situated in a densely populated region. He indicates that this region belongs to the drainage area of the Ogove, the Ivindo rising near this place. This is an important discovery, as it considerably enlarges the drainage area of the Ogove. De Brazza returned to the Kongo by way of the Likuala. Close to the mouth of this river, a little farther east, the Sanga, which according to von François carries a great volume of water, empties. Therefore it must drain an extensive area. As the western tributaries of the Obangi are of no great importance, and the tributaries of the Ogove extend so far east, we must suppose that its sources lie far north, and it may be that the rivers Kadei and Nana, which have been described to Flegel by the natives, are its upper course.

Since the accompanying sketch-map was engraved, we learn from

tirely upon the qualifications of those who form the committee, and we presume, that, composed as it is of some of the most eminent of English investigators, its conclusion will receive the most respectful and careful consideration by the scientific world. The report is signed by James Paget, Chairman; T. Lauder Brunton, George Fleming, Joseph Lister, Richard Quain, Henry E. Roscoe, I. Burdon Sanderson, and Victor Horsley. We venture to say that no more eminent committee was ever appointed on such an investigation.

In the course of its inquiry the committee visited Paris to obtain information from Pasteur himself, and to observe his method of treatment. They investigated a considerable number of persons inoculated by him. Mr. Horsley conducted a careful series of experiments on the lower animals, and entirely confirms Pasteur's discovery of a method by which they may be protected from the infection of rabies. The committee states that "it may be deemed certain that M. Pasteur has discovered a method of protection from rabies comparable with that which vaccination affords against infection from small-pox. It would be difficult to over-estimate the im-

portance of the discovery, whether for its practical utility or for its application in general pathology." The committee investigated ninety cases treated by Pasteur. Of this number, twenty-four had been bitten on naked parts by undoubtedly rabid dogs, and the wounds were not cauterized, nor otherwise treated in any way likely to have prevented the action of the virus. Of thirty-one that were bitten, there was no clear evidence that the dogs were rabid, and in others the bites had been inflicted through the clothes. It is estimated, from experience of the results of bites in other cases, that had they not been inoculated, not less than eight among these ninety persons would have died. Not one of them has shown since the inoculation any signs of hydrophobia. The committee thinks it certain that the inoculations practised by M. Pasteur have prevented the occurrence of hydrophobia in a large proportion of those who, if they had not been so inoculated, would have died of that disease. And his discovery shows that it may become possible to arrest by inoculation, even after infection, other diseases besides hydrophobia.

If rabies be not reduced among the dogs of England, there will always be a large number of persons who will require treatment. The average annual number of deaths from hydrophobia during the ten years ending 1885, was, in all England, 43; in London alone, 8.5. These numbers may be taken as representing only five per cent of the persons bitten, so that the preventive treatment will be required for 860 persons in all England, and for 170 in London alone.

In commenting on this report of the committee, the London *Lancet* says that "their verdict is the most important yet pronounced upon the subject, and must go far to decide the question of the prophylactic value of the inoculation of Pasteur. The conclusion that the method has saved a considerable number of lives, and that it is at present, and probably will be for long, the only mode of saving from death those who have been bitten by a rabid dog, affords strong support to Pasteur's conclusions, and, we need hardly say, must have most important practical results."

MEASLES.—The prevalence of measles in some parts of the world, and its fatality, have aroused health-authorities to such an appreciation of the necessity for restricting the spread of this disease, that official steps are being taken for the attainment of this end. A recent occurrence at Portsmouth, England, makes the necessity for this work more emphatic. H. M. S. *Crocodile* arrived at that place with forty persons sick with measles on board, who were permitted to land. From these individuals the disease has spread to an epidemic, and at last reports the number of deaths was one hundred and ninety-seven.

LEPROSY IN LOUISIANA.—Considerable excitement has been occasioned in Louisiana by the report that leprosy existed at St. Martinsville in that State. The State Board of Health has made an examination, and finds that five persons are suffering from undoubted leprosy, while three others are as yet in doubt.

BOOK—REVIEWS.

Chance and Luck: a Discussion of the Laws of Luck, Coincidences, Wagers, Lotteries, and the Fallacies of Gambling; with Notes on Poker and Martingales. By RICHARD A. PROCTOR. London, Longmans, Green, & Co.

THE persistency of a superstition can generally be referred to the subtleness and persuasiveness of the logic upon which it is founded, or to the fact that it appeals to a strong instinct in human nature. Doubtless both these influences have been at work in keeping alive, among those in whom the hazardous instinct is at all strong, a fondness towards a belief in their own favoritism, in the obscure forces which control luck, and in the sundry other agencies which go to make of chance something which is more than chance. For the benefit of such,—and they form a respectable portion, both in size and ability, of mankind,—Mr. Proctor has written this book. He hopes to be able to convince a few of the errors of their ways, sadly recognizing "that the gambling fraternity will continue to proclaim their belief in luck, . . . and the community on whom they prey will, for the most part, continue to submit to the process of plucking, in full belief that they are on their way to fortune."

The wide-spread belief in luck is in many ways easy to account

for, and even to defend. There is an element of chance that enters in the lives of every one of us; and it is but natural that where this chance favors the success of our projects,—though not the least to our credit,—this should have a decided influence in the shaping of our character. Much that is attributed to good fortune is really good common sense and wise forethought; but, allowing for that, as long as there remains this element of uncertainty in our lives, it is evident that there must be certain individuals who are lucky, in the sense that they have been fortunate when they had no very good reason to expect success, and certain others who have been unlucky under the same circumstances. But this, Mr. Proctor well insists, is a very different thing from the common conception of a lucky individual, which regards such a man as more likely to be fortunate in success depending entirely on chance, in the future; as a chosen being for whose benefit the laws of probabilities will be suspended, and who can, even with considerable confidence, count upon such benign intervention. It is this conception that has the strongest hold upon gamblers, upon the wisest and sharpest of them, as well as upon the people at large, and is a very ridiculous and a very dangerous superstition. If some way could be devised by which the expectation, the subjective feeling of confidence, could be properly proportioned to the mathematical chance of securing the desired prize, lotteries could no longer exist, and the chance forms of gambling would appear as utter folly. The methods by which such occupations are carried on are devised to carefully prevent any such enlightenment, and they easily succeed in so doing.

The logic of the matter is very simple. Take lotteries as an example. If ten persons each deposit five dollars, and agree that the one throwing the highest number of points with a pair of dice shall receive the fifty dollars, that would be a fair lottery. To test its fairness, we have simply to consider, that, if one person bought all ten deposits, he would be sure to win, and would neither lose nor gain: in other words, mathematically the price to be paid for a share in a lottery is obtained by dividing the amount that can be gained by the number of shares. No lottery of this sort would pay: hence no paying lottery is fair, and every lottery that exists pays those who control it very well indeed. The Louisiana lottery, the peculiarity of which Mr. Proctor characterizes as 'the calm admission, in all advertisements, that it is a gross and unmitigated swindle,' sells monthly 100,000 tickets at five dollars each. Deducting from the \$500,000 thus received as much as \$10,000 for expenses, and a similar amount for 'the charitable and educational purposes' for which the State sanctions the lottery, there remain \$480,000. Instead of distributing all this in prizes, they distribute only \$265,000; and thus, when all the tickets are sold,—and few are ever left,—the managers have a clear profit of forty-five per cent per month. This is exactly the same kind of swindling as would be committed by the man who invited the ten persons to deposit their five dollars, were he to give the one who threw the highest number of points \$26.50, and quietly pocket the \$23.50 as a reward for his trouble. Lotteries exist and pay, because people are willing to give more for the chance of securing a prize than they ought to give. They dwell frequently and long on the immensity of the prize, entirely underestimating the slowness of the possibility of their securing it, and thus cherish a sort of optimism which overlooks barefaced robbery and tolerates the most glaring frauds. That such is the case was experimentally demonstrated by the English Government. Tickets for a lottery were offered for sale, not at a fixed price, but for what they would fetch. The contractors bought of the government tickets mathematically worth £10 at £16, and again sold the tickets at a large advance. The public was perfectly willing, and actually asked, to be plundered.

Gambling-banks and the superstitions of gamblers offer a still more interesting topic. Here there is often much ingenuity displayed in arranging plans by which apparently fortunes must be won, and in defending pet notions with an array of apparently sound argument. But the reason why a bank must win has often been exposed. It is simply that it reserves for itself, under certain conditions (apparently very unlikely), a certain sum, apparently small, or it stakes a larger sum at exaggerated odds for the great probability of winning a small fee. Thus the *refait* in *rouge et noir*, which apparently is a most improbable event, must, by the doctrine

of probabilities, occur sufficiently often to give the bank a sure profit of 1.1 per cent on every deposit. The fallacy of those who devise sure methods of defeating the bank ('martingales,' as they are termed, lies in the fact that they neglect to consider that the fortunes of any one gambler, compared to that of the bank, is small: they prove that in the long-run they must win, forgetting that they only have a short run. As a matter of fact, when their schemes require the risk of a very large sum, they generally are afraid to make the risk, and so leave the game with the firm conviction, that, had they but possessed a little more money, success would have been insured.

The gambling superstition that has probably worked more ruin than any other is what they term the 'maturity of chances.' The gambler says, to toss aces six times running is certainly a highly improbable event: if, therefore, aces have fallen five times, it is much more certain that the next throw will not fall an ace than if ace had not been thrown five times. The absurdity of this doctrine, apart from its being disproved by actual trial, can be easily shown. The chance of the occurrence of a certain event has no meaning after the event has occurred: it then has become a certainty. The chances of throwing an ace are as 1 to 6 on each throw, and entirely without reference to other throws. If I enter a room and pick up a die, the chances of my throwing an ace are as 1 to 6: to be told afterwards that five aces had just been thrown with that die, could evidently not influence the chances of my throwing an ace. Yet this doctrine is defended in the books on gambling, and is carried into practice at the gaming-table, to the ruin of many of its adherents.

Mr. Proctor gives very clear expositions of the fallacies underlying such beliefs; makes a forcible statement of the swindling processes to which even the better class of gamblers, lottery-holders, and the like, must resort; and illustrates his arguments with facts derived from actual experience. The book is no theorist's exposition merely, — it really ought not to matter if it were, because here theory and practice have been found to agree, — and is thus excellently calculated to meet the purpose for which it was written. It is in every respect a commendable work. Men desirous of guiding their actions by reason will here find expressed the position they should take on matters of chance and luck.

Our Temperaments; their Study and their Teaching. By ALEXANDER STEWART. London, Crosby, Lockwood, & Co. 8°.

DR. STEWART gives in his preface a description of what this book is. "Impressed by the frequency with which the word 'temperament' is used to account for the action that is taken not only on the ordinary but on the eventful occurrences of life; while so little is known of the temperaments, that very few outside the medical profession can name off-hand the four principal ones, — the sanguine, the bilious, the lymphatic, and the nervous, — I have endeavored to construct, from scattered and scanty material and my own observation, a practical guide by which observers may know the temperament of any one by looking at him, and associate with it certain mental qualities and traits of character." The author points out the disparity between the part the temperaments play in medicine and in general literature. He accords them a more definite value than expression and physiognomy, and believes them more available than phrenology, for the reason that the physical characteristics of the temperaments are definite, few, and readily observed.

Dr. Stewart has collated an immense mass of observations on the temperaments from ancient, mediæval, and modern literature, and uses it to illustrate and expound his own argument. He first makes clear the ordinarily received medical doctrine of the temperaments, and then endeavors to give it added precision and scientific value. Dr. Stewart himself recognizes the just limitations of the doctrine which he develops. He sees, in the first place, that it applies only to civilized races; and, second, since the physical characteristics and the influences that modify the mental habit vary in different climates and countries, that it holds most forcibly with the British, since it is from that nation that the distinctions have been drawn.

Perhaps the greatest advance made by the present writer is the assignment of precise form-characteristics to the different temperaments. He gives a table, in which one column contains the physi-

cal, and the other the mental, characteristics of the four pure temperaments. These are very full and explicit. The physical characteristics are seven, — three relating to color (of the hair, eyes, and complexion), and four to form (of the face, nose, neck, and body).

The nervous temperament is accorded a special chapter, that the common error of confusing it with nervousness may be avoided. Nervousness, so far from being a normal characteristic, is described as "altogether a departure from the natural or healthy manifestations of the temperament." To the nervous temperament is ascribed the tempering, softening, and refining of the other three. "What literature would be without the grace, the tenderness, the sublimity of poetry, the other temperaments would be without the nervous" (p. 132). After a discussion of the compound temperaments, the practical applications of our knowledge of them are taken up. The aid they may render in education, in the choice of a congenial and fitting profession, and in the promotion of health, is developed in a most interesting way. By way of illustrating the form-characteristics mentioned, and to enable observers to classify faces by them, a number of engravings are given from Lodge's 'Historical Portraits.' Dr. Stewart has certainly given us a most entertaining and valuable study in anthropology, and the publishers have done their full share in making it attractive to the reader.

Report of the Scientific Results of the Exploring Voyage of the 'Challenger.' Zoölogy, vol. xix. London, Government. 4°.

IN this volume, Hubrecht reports on the *Nemertea*, his contribution comprising one hundred and fifty pages and sixteen finely drawn plates. The 'Challenger' nemerteans were few in number, and only some twenty stations afforded specimens. Of these stations, only five were over one hundred fathoms, and only three of these exceeded one thousand fathoms. *Carinina grata* and *Cerebratulus angusticeps* were obtained from these three, but the last species was dredged elsewhere at a depth of only ten fathoms. The most aberrant types were the above-mentioned *Carinina* and the pelagic *Pelagonemertes*. The section-cutter was the chief instrument of investigation, and the number of sections made exceeded 19,500. The report is divided into a systematic and an anatomical part, followed by a chapter on theoretical considerations. The latter will afford reading of much interest to those who are not engaged in the study of nemerteans. The conclusion reached by the author is, that "more than any other class of invertebrate animals, the *Nemertea* have preserved in their organization traces of such features as must have been characteristic of those animal forms by which a transition has been gradually brought about from the archicæulous diploblastic (cœlenterate) type to those enterocœlous *Triploblastica* that have afterward developed into the *Chordata* (*Urochorda*, *Hemichorda*, *Cephalochorda*, and *Vertebrata*)." This statement excludes the idea of any direct ancestral relations between *Nemertea* and *Chordata*, and fully recognizes the points of agreement between *Balanoglossus* and *Amphioxus*.

The clear and weighty arguments by which the author sustains this proposition do not admit of condensation.

The reports on the *Cumacea* and *Phyllocarida* are by Prof. G. O. Sars, where that distinguished naturalist finds himself on congenial ground. The number of species of the former group obtained by the 'Challenger' is fifteen, ranging, among them, from the surface to 2,050 fathoms in bathymetric distribution. In addition to the more purely systematic part, Professor Sars discusses the derivation of the group, and gives a summary of the characters of all the families, and enumerates the genera of which each is composed. The memoir is illustrated by eleven plates, distinguished by that accuracy and beauty which characterize all the work of Professor Sars' facile pencil.

To the single genus of recent *Phyllocarida* heretofore known (all the others being palæozoic fossils), the 'Challenger' expedition added two new generic types, which are naturally of great interest. The illustration and description of these take but three plates and some thirty odd pages of text, in which the author fully discusses the history, morphology, and development of the group, and the homologies of the several parts in the *Nebaliida* with those of other recent *Crustacea*. As regards the phylogenetic relations, the

author is inclined to indorse the suggestions of Packard rather than the hypotheses of Metchnikoff and Boas.

The report on the *Pteropoda gymnosomata* is in some respects disappointing. It was hoped by those interested in these animals that the extraordinary opportunities offered by the 'Challenger' voyage would result in a monographic series of illustrations, giving us satisfactory artistic representations of these exquisite 'sea-butterflies' taken from life. Instead of this, we have a series of diagrammatic plates taken from pickled specimens, and in nearly every case grossly misrepresenting the form and proportions of the living animal. M. Paul Pelseneer, who reports on the group, is evidently quite unacquainted with these animals under their normal conditions of existence, — an ignorance which is not unpardonable, but which has led him into sundry observations which future experience, should he have it, will enable him to modify in the direction of accuracy.

For the rest, considering the chaos which preceded Dr. Boas's monograph, in the *Spolia Atlantica*, in regard to the species, sometimes well figured but poorly described, sometimes unfigured, and sometimes described from immature or mutilated specimens, — considering all this confusion, and finding the characters of form and color familiar to those who know these animals in life, gone irrevocably in pickled specimens, it is not surprising that the author should be disposed to criticise sharply, if not altogether justly, the work of a past epoch. He has brought a certain order out of the confusion, and his work will be helpful to the student of museum specimens. The ideal iconography, which we might have had, of the animals as they live and move, must, however, be looked for from some other direction.

NOTES AND NEWS.

THE government of the province of Cordoba (Argentine Republic) has established a meteorological service, of which Prof. Oscar Doering will be in charge. The new institute will be independent of the national meteorological office which was founded by Mr. Gould. The officers of telegraph and telephone stations will be obliged to make observations in conformity with the instructions. The work will be begun next year on forty stations.

— The first number of the *American Journal of Psychology* will appear early in October. Among the articles which will probably appear in that or the succeeding numbers are the following: 'On Gradual Increments of Sensation,' 'New Methods and Further Results in the Study of the Knee-Jerk,' 'Psycho-Physic Methods and Star Magnitudes,' 'A Criticism of Psycho-Physic Methods and Results,' 'A New Binocular Phenomenon and its Use in Determining the Empirical Horopter,' 'A Review of Contemporary Methods and Results in the Histology of the Central Nervous System in Europe,' 'Paranoia. — A detailed study of a case extending over many years,' 'An Important Study of the Play-Instinct in Children,' 'A Further Study of Heracleitus,' 'An Extended Review of the Work of the English Society for Psychological Research.' The journal will also contain many digests and critiques of current psychological literature, both books and articles.

— The following statistics have been compiled, for the U. S. Geological Survey, by Charles A. Ashburner, principally from the direct returns of the operators of individual coal-mines, supplemented by valuable contributions from State officials. The total production of all kinds of coal in 1886, exclusive of that consumed at the mines, known as colliery consumption, was 107,682,209 short tons, valued at \$147,112,755 at the mines. This may be divided into Pennsylvania anthracite, 36,696,475 short or 32,764,710 long tons, valued at \$71,558,126; all other coals, including bituminous, brown coal, lignite, and small lots of anthracite produced in Arkansas and Colorado, 70,985,734 short tons, valued at \$75,554,629. The colliery consumption at the individual mines varies from nothing to 8 per cent of the total product, being greatest at special Pennsylvania anthracite mines, and lowest at those bituminous mines where the bed is nearly horizontal and where no steam-power or ventilating furnaces are employed. The averages for the different States vary from 3 to 6 per cent, the latter being the average in the Pennsylvania anthracite region. The total production, in-

cluding colliery consumption, was: Pennsylvania anthracite, 34,853,077 long or 39,035,446 short tons, all other coals, 73,707,957 short tons; making the total absolute production of all coals in the United States 112,743,403 short tons, valued as follows: anthracite, \$76,119,120; bituminous, \$78,481,056; total value, \$154,600,176. The total production of Pennsylvania anthracite, including colliery consumption, was 699,473 short tons in excess of that produced in 1885, but its value was \$552,828 less. The total production of bituminous coal was 1,086,408 short tons greater than in 1885, while its value was \$3,866,592 less. The total production of all kinds of coal shows a net gain of 1,785,881 short tons compared with 1885, but a loss in spot value of \$4,419,420.

— The *Naturwissenschaftliche Rundschau* gives an abstract of J. Coaz's observations on the planerogams first taking possession of the land at the end of retreating glaciers. The end of the Rhone glacier has been marked yearly since 1874, and therefore Coaz made his observations at this place. In the zone left by the ice in 1874, he found 39 species; in the zone following, 37: 23 species grew in the zone left by the ice in 1876, but then the figures fall off to 12. In the zone of 1881 only 7 are found, and in that of 1881 only a single species. This is *Saxifraga aizoides*. *Epilobium Fletscheri* and *Oxyria digyna* grow in all zones except the last. Willows do not occur except in the first two zones. The observations were made in 1883.

LETTERS TO THE EDITOR.

. The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Scientific Ballooning.

I AGREE most heartily with Professor Waldo, in *Science* for July 15, that "no meteorological data are so much to be desired as those which are now obtained for short, irregular intervals, by balloons." Six years ago, when there was talk of a balloon-voyage from Minneapolis to the Atlantic, I wrote a note regarding the relative importance of the free and captive balloon. I was not then aware that no balloon had ever been kept afloat at a half-mile height more than twenty hours, and then only by the use of about half a ton of ballast. Probably there are now several balloons, in this country, that can be floated more than twenty-four hours by using four hundred or five hundred pounds of ballast each day. The great desideratum in ballooning is a gas-tight envelope. The best record I know of is the suspension of a balloon at about one thousand feet, for thirteen hours, with a loss of about one hundred and sixty pounds of sand. I think an approximation to a tight balloon may be made by increasing the number of coats of varnish, but this would bring about an unwieldy envelope and one likely to crack when emptied of gas.

If we had such an envelope, however, it would be impossible to keep the balloon captive, at a half-mile height, in a wind much over five miles per hour. As the chief investigations we wish to make are during the progress of storms, when the velocity of the current rises to forty and fifty miles per hour, it can hardly be considered that a captive balloon is practicable.

A captive balloon, however, can never give us what we wish; namely, the distribution of temperature, moisture, etc., in a vertical direction, nor in a horizontal stratum. Just the height to which we must go is in some doubt, some authorities placing it at 20,000 feet and over. I think that at least nine-tenths of the disturbance is below 6000 feet, so that the exploration is by no means as formidable as it might seem at first. There is nothing the aeronaut, with a few hundred pounds of ballast, has so completely under his control as an up-and-down movement, and he can satisfy the most enthusiastic observer with all he may wish of such movement. The weight of an observer, perhaps, is the least objectionable point in ballooning. In most cases at least two men are taken, together

with a few hundred pounds of sand. If the envelope were absolutely tight, this would be ample for several ascents to 10,000 feet, or to keep the balloon in suspension many days. Nothing of scientific accuracy can be had at a high level without a practised hand on the spot. Questions of exposure of instruments, observations of clouds, etc., demand an immediate answer at each record, if we desire valuable observations. Glaisher made thousands of observations of the moisture-contents of the air in his memorable scientific ascents, but, though these have been utilized by others in doubtful computations, he himself does not summarize them in considering his results. All who have tried to make humidity-observations in a room, with no air stirring (which is precisely the condition in a balloon), know how exceedingly unsatisfactory they are.

I believe that the investigations needed may be made at an expense much less than is ordinarily supposed. There is needed a balloon of about 60,000 cubic feet capacity (a larger one would be too unwieldy, and is not necessary for ascents up to 20,000 feet). The gas for inflation should be the last that comes in the process of manufacture: this is poor in illuminating power, because it has less carbon, but it is nearly one-fourth more buoyant than ordinary coal-gas. This is not exactly a refuse product, yet it can be had very cheaply. It would be a most excellent plan to send up four balloons at once, about two hundred miles from the centre of a storm, in the north-east, north-west, south-west, and south-east quadrants. But, as this would be rather expensive, we must explore the most interesting point first. I would send up the balloon either to the south-west or west of a storm: at a height of 6,000 feet, it would, in all probability, outstrip the storm, and the descent could be made either in the centre or a little to the east of it. We could then either make another ascent immediately, or wait till the storm has passed overhead, and then make another trip just as at first. This will enable us to determine, not only the vertical distribution of temperature and moisture in the neighborhood of the storm, but also the action, whirling or otherwise, that takes place at the seat of the storm, or where the 'power' of the storm is developed. When the balloon is no longer able to rise, a fresh supply of gas may be carried to it in a small balloon, or in a long flexible cylinder (as suggested by Professor King). If near any gas-works, the balloon may be towed near enough to obtain a fresh supply. As about 30,000 feet of gas would be needed to float the balloon and all its appliances, it will be seen that this would effect a great saving. I understand perfectly that carrying out such suggestions as these may be a very difficult matter in practice, and often impossible in a high wind. For ten thousand dollars, I think, fifty or sixty ascents might be made, which would be of incalculable importance in the study of the origin, development, and progress of storms. Such investigation is absolutely necessary if we would advance our knowledge of the generation of storms. Any advance in this direction is of such moment to almost all classes of people, especially to farmers and mariners, that we may hope such a small sum will be volunteered, or obtained from government, ere long for this study.

H. ALLEN HAZEN.

Washington, D.C., July 19.

Cloud-Heights.

THE following method, which can often be used to determine the elevation of certain clouds, may interest some of your readers, particularly topographers and meteorologists.

I was watching to-day, from Little Monadnock, the shadow of a dense cumulus moving slowly along the southern slope of Monadnock, until finally the edge touched the hotel about half-way up the mountain. It occurred to me, that, if the point where I stood and the hotel were plotted on a plane-table sheet, and the sheet oriented, the elevation of the cloud could easily be found in this way. At the moment the shadow reaches the second plotted position, draw, through the station occupied by the observer, a line, and read a vertical angle to the edge of the cloud that casts the shadow. Then, through the second plotted position, draw a line in the direction of the sun. The point of intersection of these two lines is the horizontal projection of the position of a point on the edge of the cloud at the time the shadow has reached the second plotted position. The distance (to be scaled from the map) from this intersection to

the point occupied, is the base, and the vertical angle of elevation the adjacent angle of a right-triangle, of which the altitude is the height of the cloud above the observer. This may be corrected for curvature and refraction.

When a plane-table sheet is nearly complete, with many located points on it, the same cloud may be observed several times, and the determinations of altitude compared.

This method is extremely simple, and I am very anxious to have it tried. I shall not be able to do this myself for several weeks, but I hope some one who is working with a plane-table will, and let me know his results.

H. L. SMYTH.

Dublin, N.H., July 2.

The Wholesomeness of Swill-Milk.

THE discussion carried on in the pages of *Science* for some weeks past upon the healthfulness of milk from cows fed upon distillery-swill has, in my opinion, failed to definitely settle the question. There can be no doubt of the vital importance of the matter, and all physicians and sanitarians will agree that a solution of the problem is highly desirable.

1. I venture to say that no positive evidence has been submitted showing any ill effect of swill upon cows fed with it. The evils attributable to it are largely, if not entirely, to be ascribed to the unsanitary surroundings of the animals.

2. Whatever evidence has any positive value indicates that swill is equally as good and proper food (used with judgment) as hay, dried fodder, ensilage, or bulbous roots. These all differ widely in chemical composition from the green foods (grass, clover, green oats, and corn), which may be looked upon as the normal food of cows.

3. It may be worth while remembering that lactation in a dairy is not a normal process. Dairy-cows are 'milk-machines.' The dairy business would not be very profitable if lactation were not forced to some degree.

4. Experienced agriculturists, like Professor Armsby and Dr. Sturtevant (*Science*, ix. pp. 602-3), have failed to see any ill effects attributable entirely to swill, and such veterinarians of ability as Professor Law and Dr. Salmon (*Ibid*, p. 552) corroborate this testimony.

5. The facts collated by Professor Brewer (*Ibid*, p. 550), showing the ready absorption of germs and odors by milk, the transmission of the flavor of various odoriferous substances eaten by the animal to the secretion, the passage of certain drugs administered medicinally into the milk of nursing women, or the notorious fact that swill-milk stables are 'proverbially foul and stinking,' have no bearing upon the case. The evidence required to establish the unwholesomeness of swill as food for milk-giving animals must be of a different character.

6. While it may be conceded that 'chemical analyses will not settle the question' of the wholesomeness of swill-milk, the fact remains that we have at present no other way of determining the physical qualities of a specimen of milk. Bacteriological investigation may determine the presence of the germs of tuberculosis, typhoid, and, in view of recent discoveries, of scarlet-fever, but will not enable us to ascertain the relative proportions of saccharine, fatty, aqueous, or proteid matters present. Chemistry is here still our main-stay, and, other things being equal (more definitely, disease-germs being absent), a specimen of milk nearly approaching the chemical standard established by Koenig may be looked upon as a wholesome food. Other factors besides the food of the animal enter into the production of milk. The age of the animal, period of lactation, time when the milk is drawn, and general sanitary condition, must not be ignored.

7. The asserted greater firmness, and consequent indigestibility, of the coagulum in swill-milk is not based upon a sufficient number of observations to admit of unquestioned acceptance. It should be easy to determine this in any chemical laboratory. No single series of observations would decide this, however. It would be necessary to test milk from cows fed upon swill but kept under good sanitary conditions, side by side with milk from animals kept under the ordinary conditions of city stable-life, and fed upon various foods.

8. A scientific solution of the question will not be furthered by

prejudiced appeals or unreasoning denunciation. Patient investigation, keeping in view all circumstances of the question, and avoiding all one-sidedness in considering the matter, will alone bring about the object desired. Personally I at present occupy the same stand-point as Professor Armsby (*Science*, x. p. 4), "Much of the common prejudice against the use of distillery-slops appears to be occasioned by their irrational application, and frequently by the filthy surroundings of the animals, rather than by any thing injurious in the feeding-stuff itself." GEORGE H. ROHÉ.

Baltimore, July 15.

The Hudson Bay Route.

IN your article on 'The New Route from England to Eastern Asia, and the Hudson Bay Route' (Vol. x. No. 231), you show the advantages offered by the Hudson Bay route, as the most direct available line between Yokohama and Liverpool in connection with the Canadian Pacific Railway and their line of steamers between Yokohama and Vancouver. I should like to add a few remarks on that part of it known as the Hudson Bay route.

The Canadian Government decided, that, before any such line was encouraged by subsidy, it would be advisable to determine by actual observation what difficulties were likely to be met with; and, with this object in view, established several observing stations in the Strait and Bay, with men and material sufficient for continuous residence there during 1884-6. Complete details of these observations are published in the annual reports of the Marine Department.

A fact well established by these observations was that navigation was limited in these years to three months for the ordinary ocean-steamer; and that for a class of steamer specially constructed to withstand the lateral thrust of the ice, and to push her way amidst the outflowing arctic ice, four, or at most five months would be the limit, depending on whether the season was a late or early one. We must not forget, however, that in the earlier days at least of this route, before the telegraph and cable will have reached these waters, steamers will not attempt the passage at these earlier dates, fearing an arrival off the mouth of the Strait and an inactive wait for a late season's opening, so that practically such an advantage would be lost, and two months and a half become the period over which a steamer could be certain of making an uninterrupted passage during any season.

In considering the possibility of the route being equipped with a special class of steamer, we will have to remember that the required conditions will be strength and power rather than speed, and that therefore their field for employment outside of these few months' service would be of very limited extent.

The special objection I would point out as to this route, apart from the ice-question, is the difficulty of the passage itself: an unknown, an unlighted coast-line, with very few harbors of refuge, or none at all, and very little room to ride out a gale; extreme depths of water, one hundred fathoms being often found right up to the shore, with generally very foul holding-ground where the depths are more moderate. In foul weather, no sounding being possible that would be of value, a vessel would receive no warning of her proximity to the coast until the information would be of little or no avail.

Although fogs are of less frequent occurrence than off the Newfoundland coast, where the necessary conditions are most favorable, they are not infrequent during the season of navigation, Belle-Isle having an average of 1,600 hours fog during the year, as compared with 420 for the Strait during the same period. On the other hand, although the total amount of precipitation, in the Strait, was not great, rain or snow fell on an average of a little more than every other day, with its attendant thick weather.

In addition to and connection with these difficulties, we must not forget that the proximity of the Strait to the Magnetic Pole results in the horizontal, or directive, force of the magnetic-needle being so diminished that the common compass is perfectly useless; and even in the case of the Thomson compass, disturbing elements on ship-board have, in consequence, their values so increased (relatively) that sources of error might arise, the effects of which could not be counted on during thick weather.

That the people of Manitoba are seemingly satisfied with the feasibility of this route, there can be no doubt, if we may judge from the advance they have made with the construction of the railway from Winnipeg to Churchill; but, in face of the facts obtained from the observations made in the Strait, one must conclude that the resources of Hudson Bay itself and the country intervening are looked upon as reason sufficient for the construction, independently of the value of the road as a connecting link to the Hudson Bay route.

In conclusion, although it would be difficult to say that, with the appliances science is constantly developing to meet particular cases of difficulty, the navigation of Hudson Strait will not be possible for five or six months when the necessity arises, we cannot but conclude that, with the means at our disposal to-day, the navigation of Hudson Strait is possible for such a limited period, and under such serious disadvantages, that as a development of the 'New Route from England to Eastern Asia' we need not consider it as an immediate probability.

W. A. ASHE.

The Observatory, Quebec, July 16.

The Wanton Destruction of the Florida Heronries.

CANNOT general legislation, cannot State legislation, or cannot somebody raise a hand to stay the terrible, the shameless extermination of the herons at their breeding-grounds in the south-western parts of the State of Florida?

As I pen these lines this murderous work is being actively carried on, and apparently in the most lawless and reckless manner possible,—a disgrace to the entire country,—for one of America's grandest and most interesting natural features, her heronries, are simply, and without a check of any kind, being ruthlessly wiped out of existence. Prompted by an insatiable greed for gain, the 'plume-traders' of the markets are upon their grounds in numbers, and hundreds of these birds are now daily falling to their unceasing fire, simply that they may have their backs robbed of a few feathers to gratify a passing fashion. *The Auk* is now publishing an admirable series of articles on this subject from the able pen of Mr. W. E. D. Scott, at present on a scientific expedition in Florida, and I have just read his contribution to the July number of that journal. Mr. Scott has very recently made camp at a number of these heronries, and I quote a few of his words in order to show what work is going on there. At Matlacha Pass, near Charlotte Harbor, Pine Island has a heronry, and here one Johnson was at work. "A few herons were to be seen from time to time flying to the island, and presently I took the small boat, and went ashore to reconnoitre. This had evidently been only a short time before a large rookery. The trees were full of nests, some of which still contained eggs, and hundreds of broken eggs strewed the ground everywhere. Fish-crows and both kinds of buzzards were present in great numbers, and were rapidly destroying the remaining eggs. I found a huge pile of dead, half-decayed birds, lying on the ground, which had apparently been killed for a day or two. All of them had the 'plumes' taken, with a patch of the skin from the back, and some had the wings cut off; otherwise they were uninjured. I counted over two hundred birds treated in this way." In some places, Mr. Scott found hundreds of the young herons just starving in their nests; in others, the gunners beneath the trees shooting down the magnificent birds in hundreds, stripping their backs, and leaving their carcasses to rot upon the ground. Instances were noted without number where, during the breeding-season, the poor, affrighted survivors were driven to strange islands, dropping their eggs in quantities from the trees where they fearfully roosted for the night. A few more years, one or two at the most, and this disgraceful murder will cease, for the simple reason that there will no more victims for the murderers to prey upon,—and in the name of nature, and in the name of the shadows of the sweet old romances that have come down to us of the heronries of history, are these timid, and most engaging of all our larger water-fowl, our own American herons, to be destroyed in this manner!

Twenty years ago southern Florida was the site of the grandest heronries in all the world, and to-day this State is making enviable progress, and many cultured people are flocking to her for a permanent home: is she to stand idly by and watch what will surely

be one of her greatest natural attractions stamped out in a few months under her very eyes, — a work, that, when fully known, as it will surely be, will pass down as one of the blackest pages in her history? A quarter of a century ago the writer was at Charlotte Harbor himself, and well do I remember my unbounded enthusiasm as my eyes first feasted upon the sight of a Floridian heronry: many, many, species, represented by thousands upon thousands of individuals, were ranged along the beaches, or covered the cypress tops, where their nests were in hundreds. Never shall I forget their lovely uniforms as they glistened in the soft atmosphere of that sub-tropical land: some were snowy white, others a charming blue, or warm chestnut, while, more beautiful than all, the wondrous rosy tints of the spoonbills fairly shone in the bright sunlight.

Really I am sad as I see, only too vividly in my mind, the disgusting slaughter that is now being perpetrated in their very midst. Entire rookeries have been exterminated, and others reduced to a few, very few, pairs of birds, now so wild and suspicious that it requires the skill of the rifleman to capture them.

R. W. SHUFELDT.

Fort Wingate, N.Mex., July 14.

Tornado 'Power.'

REFERRING to a communication by H. Allen Hazen, in *Science* of July 8, entitled 'Theoretical Meteorology,' in which he states that "theoretical meteorology most signally fails in its attempts to explain our most violent storms and tornadoes," and, "that the theory that the sun's heat could start a vertical current, which, with the condensation of moisture in the upper atmosphere would give rise to winds of 200 to 300 miles per hour seems incredible," and "that the attempt to meet the difficulties by suggesting 'great contrasts in temperature,' 'meeting of warm southerly and cold northerly winds,' etc., does not seem at all satisfactory," I would say that there appears to be a disposition on the part of writers on scientific subjects, more particularly as relates to meteorology, to sacrifice common-sense reasoning and probable facts to profound but improbable theories, which, while they do, and are probably intended to, fill the common mind with wonder at such amazing displays of learning, are unsatisfactory and worthless from a practical scientific standpoint.

The attempt to prove that wind-velocity constitutes the 'power' of tornadoes always did and always will signally fail; nor will it be possible to convince any one who possesses a knowledge of meteorology, that air-currents can be made to attain the several-thousand-mile per hour velocity which would be required to effect the results of tornado action. It is evident to the practical mind that the suggestions referred to by Professor Hazen do not meet the difficulties involved in explaining the violent character of these phenomena, and it is equally evident that more satisfactory suggestions concerning them have not been brought to, or received, his intelligent attention.

It has been claimed and shown that the 'power' of tornadoes is electrical, and it has been demonstrated that trees and twigs which had been subjected to their action bore conclusive proof of this fact. It is not known, however, that theories have been advanced in explanation of the processes whereby the electric fluid is so largely collected within the tornado-funnel, and herein is embodied the object of this communication.

The meeting of warm southerly and cold northerly winds, in the southern quadrants of low-barometer areas, occasions great contrasts in humidity and temperature in a limited area, and it is well known that these conditions are essential to a storm's development and existence. Tornadoes and local storms are, in all instances, subsidiary to extensive storm-systems, and invariably occur at the point where, in accord with the laws governing the circulation of wind in low-barometer areas, the warm and cold currents are brought into opposition. A natural result of the meeting of warm and cold masses of air would be the elevating of the former to higher altitudes, if for no other reason than on account of their relative specific gravity: the ascending currents would, on attaining a proper elevation, precipitate their moisture, and the continual and large inpouring of these opposing currents, in any given locality, would intensify the elements of disturbance. It is conceded that

the angle of contact of air-currents, to the south-eastward of the centres of general storms, contributes to impart a rotary movement, and ascending warm-air currents would naturally assume that motion; and, in the case of tornadoes and local storms, this whirl is most marked at a distance from the earth's surface, or at the point where the moisture in the ascending air is precipitated. That this mass of revolving air is well charged with electricity is shown by the heavy electrical discharges which are commonly observed within its body and in its immediate vicinity. When, through its whirling motion, or the electrical attraction offered by the earth, the extremity of this generally low-lying cloud descends to the earth's surface, there is formed a column of very moist air extending from earth to cloud; and, as moist air is one of the best known conductors of electricity, and the earth is the great reservoir for the electric fluid, the tornado-funnel furnishes the medium of communication by means of which the fluid may leave the earth, and the collecting of vast quantities of both positive and negative electricity within such confined limits would naturally give rise to tremendous exhibitions of its power.

Every observable feature of tornadoes shows them to be electrical storms developed under unusually well-marked conditions. Their action and results are essentially electric, but until the true nature and composition of their mysterious element is known, the exact formula of its action as the destructive agent of local storms cannot be presented. We only know that under certain conditions it will produce certain results. Its presence in tornadoes, in enormous quantities, is shown, and its accountability for the destructiveness of these energetic phenomena is claimed, to the almost total exclusion of the wind-velocity theory, which is not only an improbable, but, it is perfectly safe to say, an impossible one. This is a fundamental proposition established by actual results on the spot where the 'power' of these storms has manifested itself, and is deserving of more consideration than has heretofore been accorded it.

E. B. GARRIATT.

Signal Office, Washington, July 15.

Theoretical Meteorology.

THERE is no contradiction whatever between page 51 and page 328 of 'Recent Advances in Meteorology.' My mind, also, remains entirely unchanged with regard to the other matters in the book referred to, by Mr. Hazen, in *Science* of July 8. There are, however, some other parts of the work, which, after a lapse of nearly three years since the first writing, I would be disposed to amend, and even in some cases correct, in a second writing. This it is proposed to do in a forthcoming more popular work, so far as it shall cover the same ground.

W. FERREL.

Kansas City, July 13.

Queries.

10. ROBIN'S NEST. — Is there any thing unusual in a robin's nest built inside of a last year's nest, which in turn was built inside of a nest now two years old, and that one inside of one three years old, and so on, like the house that Jack built, until you have a pile of nests fitting into one another and numbering ten? Such a ten-storied affair was found in Potsdam, N.Y., lately, the top story being in use, while beside it on the same window-cap was another pile of three nests.

C. H. LEETE.

11. LAKE ITASCA. — There is one point in the controversy about the name of Lake Itasca, of which I have often thought, but to which I have not seen public attention directed. The priest who is said to have suggested the name is represented to have been a Latin scholar, and to have proposed a name which is intended to signify the 'true source,' *ver(itas ca)put*. Now, I have never been able to see how the words correspond to the idea. *Caput* will do for 'source;' but *veritas* is a noun and nothing else. The two nouns cannot, therefore, mean what they are represented to mean, or the Latin is not that of a classical scholar. *Verum caput* might mean the 'true source,' not, however, *veritas caput*. If there is any other explanation of the case than that the good priest was caught napping in his Latin, I should like to see it in print.

C. W. SUPER.

Athens, O., July 11.